NON-VOLATILE MULTI-STABLE MEMORY DEVICE AND METHODS OF MAKING AND USING THE SAME

ABSTRACT OF THE INVENTION

A multi-stable memory or data storage element is used in crosspoint data-storage arrays, as a switch, a memory device, or as a logical device. The general structure of the multi-stable element comprises a layered, composite medium that both transports and stores charge disposed between two electrodes. Dispersed within the composite medium are discrete charge storage particles that trap and store charge. The multi-stable element achieves an exemplary bi-stable characteristic, providing a switchable device that has two or more stable states reliably created by the application of a voltage to the device. The voltages applied to achieve the "on" state, the "off" state, any intermediate state, and to read the state of the multi-stable element are all of the same polarity. The multi-stable element is stable, cyclable, and reproducible in both the "on" state and the "off" state. The storage medium has a relatively high resistance in both its on and off states. Consequently, a dense array can be fabricated without significant cross-talk between adjacent elements. No patterning of the layer of storage medium is required.